

OCR

Oxford Cambridge and RSA

Level 3 Cambridge Technical in Engineering

05822/05823/05824/05825/05873

Unit 1: Mathematics for engineering

Monday 8 January 2018 – Afternoon

Time allowed: 1 hour 30 minutes

You must have:

- the formula booklet for Level 3 Cambridge Technical in Engineering (inserted)
- a ruler (cm/mm)
- a scientific calculator

| | | | | | | | | | | |
|---------------|---|---|---|---|---|------------------|---|---|--|--|
| First Name | | | | | | Last Name | | | | |
| Centre Number | | | | | | Candidate Number | | | | |
| Date of Birth | D | D | M | M | Y | Y | Y | Y | | |

INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number, candidate number and date of birth.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- If additional answer space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [].
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- An answer may receive no marks unless you show sufficient detail of the working to indicate that a correct method is being used.
- Final answers should be given to a degree of accuracy appropriate to the context.
- This document consists of **12** pages.

| FOR EXAMINER USE ONLY | |
|-----------------------|------------|
| Question No | Mark |
| 1 | /8 |
| 2 | /9 |
| 3 | /13 |
| 4 | /10 |
| 5 | /12 |
| 6 | /8 |
| Total | /60 |

Answer **all** the questions.

- 1 (a) Expand the brackets and simplify the expression $4x + 3(x - 2y)$.

.....
.....[2]

- (b) Factorise the following.

(i) $2xy^2 + 4x^2y$

.....
.....[2]

(ii) $x^2 - 3x - 10$

.....
.....[2]

- (c) Solve the equation.

$$2x - 3 = 1 - x$$

.....
.....
.....[2]

- 2 (a) (i) Convert $\frac{2\pi}{3}$ radians to degrees.

.....
 [1]

- (ii) Convert 270° to radians, giving your answer as a multiple of π .

.....
 [1]

- (b) The rule for placing a ladder against a wall is “bottom of ladder one unit out from the bottom of the wall, top of the ladder four units up the wall”.
 A ladder 6 m long is leant against a wall with its bottom 1.4 m away from the base of the wall on horizontal ground.

- (i) Find how far up the wall the top of the ladder rests and explain whether the rule above is obeyed.

.....

 [3]

- (ii) Find the angle that the ladder makes with the horizontal ground.

.....
 [2]

- (c) Calculate the area of a semicircular rug with diameter 3 metres.

.....
 [2]

- 3 (a) Write as a single logarithm $\log a + 2\log b$.

.....
[2]

- (b) A scientist started with 100 bacteria in a container. The growth of the bacteria can be modelled by the equation $N = 100e^{t/4}$ where N is the number of bacteria after t minutes.

- (i) Calculate the number of bacteria present when $t = 5$.

.....

[2]

- (ii) After how many minutes does the number of bacteria exceed 1000?

.....

[2]

- (c) Solve the equation $x^2 + 3x - 5 = 0$. Give your answers correct to 3 decimal places.

.....

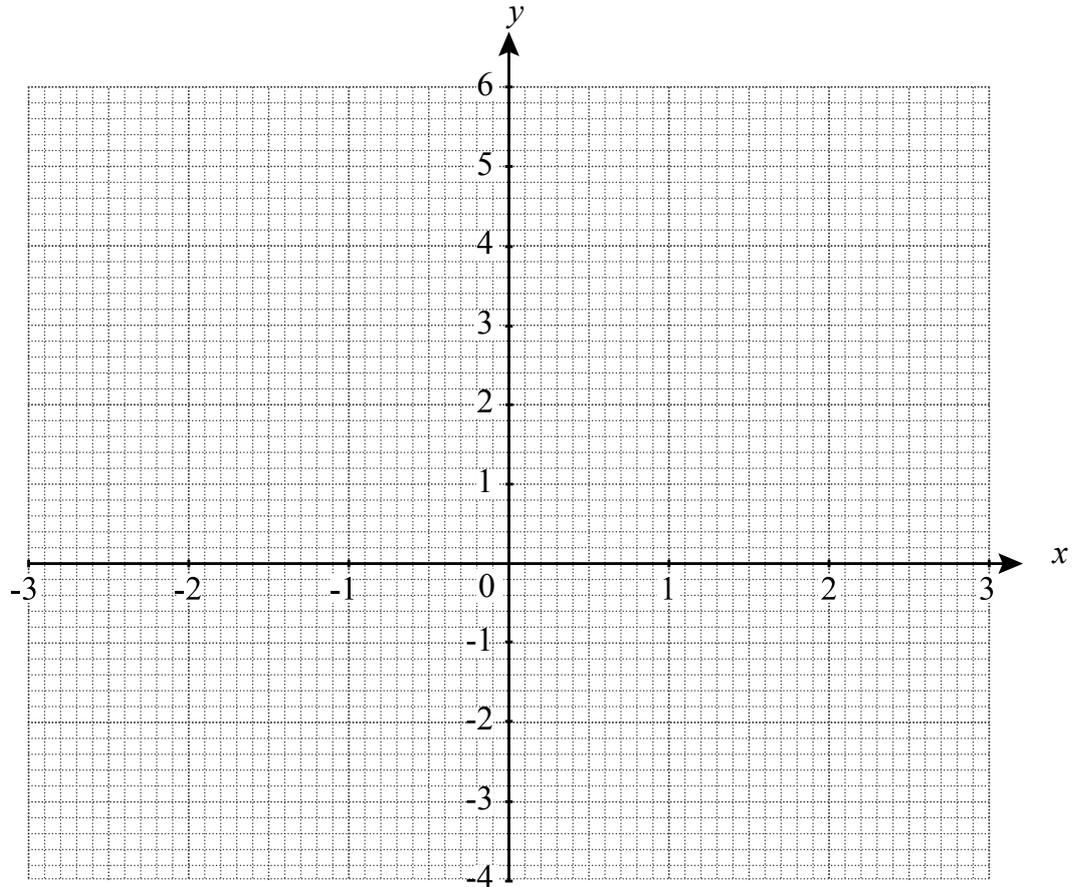
[3]

- (d) Using the factor theorem or otherwise solve the equation $x^3 - 2x^2 - x + 2 = 0$.

.....

[4]

- 4 (a) (i) On the grid below, plot the curve $y = x^3 - 3x + 1$ for $-2 \leq x \leq 2$.



[4]

- (ii) Hence write down the three roots of the equation $x^3 - 3x + 1 = 0$ correct to 1 decimal place.

.....
 [2]

(b) Find the equation of the line that passes through the point (4, 2) and is perpendicular to the line $2x + 5y = 7$.

.....

.....

.....

.....

.....

.....

..... [4]

- 6 (a) A die is biased so that when it is thrown the probability of it showing a 2 is 0.15.

Find the probability that when the die is thrown twice that the side numbered 2 will be shown at least once.

.....
.....[2]

- (b) A sample of screws taken from a production line have masses, to the nearest tenth of a gram, as shown in the frequency table below.

| | | | | | | |
|------------------|-----|-----|-----|-----|-----|-----|
| Mass (g) | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 |
| Frequency | 7 | 13 | 9 | 4 | 3 | 2 |

- (i) Find the mean and standard deviation of this sample.

Mean =

Standard deviation =

[5]

- (ii) State if the distribution of this sample has a negative skew, a positive skew or is approximately symmetrical.

.....[1]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined pages. The question number(s) must be clearly shown – for example 1(c) or 6(b).

A large rectangular area with a solid vertical line on the left side and horizontal dotted lines across the page, providing space for writing answers.

A large rectangular area designed for writing. It features a solid vertical line on the left side and a series of horizontal dotted lines extending across the page, providing a guide for text alignment and spacing.



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